BISHOP STUART UNIVERSITY

COPING WITH THE CONFLICTS BETWEEN AGRICULTURE AND
BIODIVERSITY CONSERVATION IN KIKO TOWN COUNCIL
IN THE WESTERN PARTS OF KIBALE NATIONAL
PARK, KABAROLE DISTRICT

BY

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JULY, 2017
DECLARATION

I, Isingoma Fred Baker, declare that this research dissertation is original work and has never been published or submitted for any award in any University or institution before.

Signature................................................ Date................................................

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APPROVAL

This is to certify that this research report titled "Coping with the conflicts between agriculture and biodiversity conservation in Kiko town council in the western parts of Kibale national park, Kabarole district" has been done under my supervision and is now ready for submission to the University board with my approval.

Signature: ........................................ Date: ........................................

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ASSOC. PROF. KAZIBWE FRANCIS
(SUPERVISOR)
DEDICATION

I would like to dedicate this work to my parents for their outstanding support and guidance throughout my education carrier, and to my brothers, sisters and friends who have supported me in one way or the other.
I would like to first of all thank my parents who have worked hard tirelessly to support me both financially and morally throughout my education carrier.

I would also like to thank my brothers and sisters for time and encouragement that has made this work a successful reality! My special thanks go to my children who in one way or another greatly contributed to the success of this work.

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GOD BLESS YOU ABUNDANTLY
# TABLE OF CONTENTS

DECLARATION ................................................................................................................................. i

APPROVAL ........................................................................................................................................ Error! Bookmark not defined.

DEDICATION .......................................................................................................................................... i

ACKNOWLEDGEMENT ........................................................................................................................ iv

TABLE OF CONTENTS ....................................................................................................................... v

LIST OF TABLES ........................................................................................................................................ ix

LIST OF FIGURES ................................................................................................................................... x

ABBREVIATIONS ..................................................................................................................................... x

ABSTRACT ........................................................................................................................................... xi

CHAPTER ONE ...................................................................................................................................... xi

1.0. INTRODUCTION .......................................................................................................................... 13

1.1. Background of the study ................................................................................................................. 13

1.2 Statement of the problem ................................................................................................................... 17

1.3. Objectives of the study .................................................................................................................... 18

1.3.1 Overall objective .......................................................................................................................... 18

1.3.2 Specific objective .......................................................................................................................... 18

1.4. Hypotheses ..................................................................................................................................... 19

1.5. Significance of the study ................................................................................................................ 19

1.6. Limitations of the research ............................................................................................................. 19

1.7. Scope of the study ............................................................................................................................ 20

1.7.1. Geographical scope .................................................................................................................. 20

1.7.2. Content scope ............................................................................................................................ 20
1.7.3. Time scope. .................................................................................................................. 20
1.8. Conceptual Model ........................................................................................................... 21
17 1.9. Operational Definitions ............................................................................................ 23

CHAPTER TWO ..................................................................................................................... 24
2.0 REVIEW OF LITERATURE ............................................................................................ 24
2.1. Introduction .................................................................................................................... 24
2.2. Definition of Human–wildlife conflict .......................................................................... 24
2.3. Historical background of human-wildlife conflict ......................................................... 25
2.4. Factors leading to conflicts between agriculture and biodiversity conservation ......... 26
2.4.1. Human factors ............................................................................................................ 26
2.4.2. Habitat factors .......................................................................................................... 27
2.4.3. Natural characteristics of wildlife ............................................................................. 28
2.4.4. Demographic factors ................................................................................................. 30
2.5. Consequences of the human-wildlife conflict ............................................................... 31
2.5.1. Safety issues ............................................................................................................. 31
2.5.2. Food security ............................................................................................................ 32
2.5.3. Economic and social costs Agriculture .................................................................... 34
2.6. Coping strategies with the effects of conflicts arising biodiversity conservation ....... 35
2.7. Perception of crop farmers towards the conservation of biodiversity resources Attitudes and perceptions. ............................................................................................................ 36
2.8. Alternative methods of biodiversity conservation that can allow co-existence with farming activities.......................................................................................................................... 39
2.8.1. Human-wildlife conflict management ...................................................................... 39
2.8.2. Community awareness ............................................................................................. 39
2.8.3. Compensation ........................................................................................................40
2.8.4. Intensifying human vigilance ................................................................................42
2.8.5. Guard animals .........................................................................................................42
2.8.6. Fencing ......................................................................................................................43
2.8.7. Agriculture ..............................................................................................................44
2.8.8. Husbandry ................................................................................................................44
2.8.9. Translocation ............................................................................................................45
2.9. Study gaps ....................................................................................................................45

CHAPTER THREE ..............................................................................................................46
3.0 METHODOLOGY ........................................................................................................46
3.1 Introduction ..................................................................................................................46
3.2 Study Design ................................................................................................................47
3.3 Area of study ................................................................................................................47
3.3. Study population .........................................................................................................48
3.4. Sampling procedure ....................................................................................................48
3.5. Research instruments .................................................................................................49
3.5.1. Questionnaires .......................................................................................................49
3.5.2. The interview Guide ...............................................................................................49
3.5.3. Observation .............................................................................................................49
3.6. Data Quality Control .................................................................................................50
3.6.1. Content validity .....................................................................................................50
3.6.2. Reliability of instruments .......................................................................................50
3.6.3. Confidentiality .......................................................................................................50
3.7. Data Analysis and management .................................................................................50
3.8. Anticipated Study Limitations and Delimitations ........................................52

CHAPTER FOUR ........................................................................................................53

4.0 RESULTS .............................................................................................................53

4.1 Introduction ..........................................................................................................53

4.2 Demographic characteristics of the respondents ..............................................54

4.3 Factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale national park .................................................................57

4.4 Farmers coping strategies with the effects of conflicts arising biodiversity conservation in the fringes of Kibale national park .................................................................60

4.5 Perception of crop farmers towards the conservation of biodiversity resources ....61

4.6 Alternative methods of biodiversity conservation that can allow co-existence with farming activities .................................................................................................63

CHAPTER FIVE ...........................................................................................................64

5.0 CONCLUSION AND RECOMMENDATIONS ..................................................64

5.1 Introduction ..........................................................................................................64

5.2 Summary of the study ..........................................................................................65

5.3 Discussion of Results ..........................................................................................65

5.3.1 Socio-demographic characteristics ..................................................................65

5.3.2 Factors leading to conflicts between agriculture and biodiversity conservation in the fringes ..........................................................................................................................65

5.3.3 Farmers coping strategies with the effects of conflicts arising biodiversity conservation in the fringes of Kibale national park ..........................................................................................................................67

5.3.4 Perception of crop farmers towards the conservation of biodiversity resources ..68
5.3.5 Alternative methods of biodiversity conservation that can allow co-existence with farming activities

5.4 Conclusion

5.5 Recommendations

5.6 areas for further research

REFERENCES

APPENDIX I: QUESTIONNAIRE FOR COMMUNITY MEMBERS

APPENDIX II: A MAP SHOWING KIBALE NATIONAL PARK AND KIKO TOWN COUNCIL

APPENDIX III: WORK PLAN

APPENDIX IV: STUDY BUDGET

LIST OF TABLES

Table 1: Distribution of sample households to be interviewed during the study.

Table 2: Gender of the respondents

Table 3: Age of the respondents

Table 4: Education of the respondents

Table 5: Employment Status

Table 6: Factors leading to conflicts between agriculture and biodiversity conservation in the fringes

Table 7: How the community responds to the wildlife animals that attack animals and crops

Table 8: Help community receives from Uganda Wildlife Authority to cope up with the arising conflicts in the area

Table 9: Farmers perceived benefits of conserving the biodiversity resources
Table 10: Benefits of conserving the biodiversity resources ................................................................. 62

Table 11: Methods of biodiversity conservation that can allow co-existence with farming activities
.................................................................................................................................................................................. 63

LIST OF FIGURES

Figure 1: Marital status of the respondents ......................................................................................... 55
Figure 2: Position in the community ...................................................................................................... 56
Figure 3: Sources of income .................................................................................................................. 56
Figure 4: Types of crops grown ........................................................................................................... 59

ABBREVIATIONS

IUCN International Union for the Conservation of Nature
SSA Sub-Saharan Africa
FAO Food and agriculture organisation
UWA Uganda World-life Authority
HWC Human-wildlife Conflict
WWF World Wide Fund for Nature
ABSTRACT
The study was about coping with the conflicts between agriculture and biodiversity conservation in Kiko town council in the western parts of Kibale national park, Kabarole district. Kibale National Park is surrounded by small scale farmers who depend on subsistence agriculture for their livelihoods. Due to the ever increasing population and shortage of land in the fringes of the park, humans have resorted to encroaching part of the park land to meet the food demands of the population. The growing of crops (like maize, finger millet, Sweet/Irish potatoes, bananas and cassava) and rearing animals has attracted wild animals leading to human–wildlife conflicts. Wild animals destroy crops and kill domestic animals, in retaliation humans kill them by spearing or snaring. The study was cross sectional research in nature where both quantitative and qualitative methods of data collection and analysis were used. A sample of 412 respondents was used. The study determined significant factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park such as; Educational level in years ($p=0.000$), Distance between garden and park in kilometers ($p=0.001$), type of crops growth ($p=0.000$), type of animals reared ($p=0.000$), poaching ($p=0.005$), park land encroachment ($p=0.000$), human activities ($p=0.000$). The study also investigated how farmers have coped with the effects of
conflicts arising from biodiversity conservation and this was mainly through reporting to Park Authorities, physically guarding crop gardens and animals, lighting fire in the gardens at night and planting less palatable crop species. Reducing crop raids and animal killings, eliminating environmental degradation, eco-system conservation, boost in production and productivity were the cited benefits of conserving the biodiversity resources. The study identified the alternative methods for biodiversity conservation that can allow co-existence with farming activities in the fringes of Kibale national park such as putting a ban on those who encroach park land, gusseting national parks and game reserves, eliminating poaching activities, elimination of bush and charcoal burning activities in protected areas as well as creating awareness in the community about the benefits of biodiversity conservation.

The study recommended Government in conjunction with UWA to intervene and fully compensate the affected households, this compensation should be in form of food aid or in form of money. This can help the affected households to cope up with the losses resulting from raids and domestic animal killings.
CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the study

Biodiversity conservation and agricultural production have traditionally been viewed as substantially in conflict and recent declines in biodiversity across a range of taxa have been linked to intensive agricultural production (Altieri, 2014; Barnes, 2013). Biodiversity supports many ecosystem functions that ultimately provide ecosystem services crucial to human wellbeing and survival (e.g. carbon sequestration, decomposition, pest control). Ben-Shahar, (2009) and Cochrane, (2005) similarly suggest that loss of ecosystem services is one of the imminent threats flowing from biodiversity loss. At least superficially, incorporating ecosystem services into agricultural landscapes opens the possibility of management approaches that support efficient production through the conservation of biodiversity suggesting a synergy or win-win situation.

Human activities can, in many ecosystems, be beneficial to biodiversity. In grasslands and agricultural landscapes for example, low-intensity management can lead to high densities of species (Cochrane, 2005). In Europe, the evolution and maintenance of the biodiversity of many ecosystems depends directly on traditional types of land use (Cumming, 2012; Fergusson, 2002). However, there is increasing evidence of a global decline in biodiversity (Granli, 2006). Although many factors are responsible for this decline, the root cause is invariably some form of human activity, mainly associated with changes in land use. To address the global decline in biodiversity there is, therefore, a need to identify the drivers leading to conflicts between human activities and the conservation of biodiversity, and to promote the management of these conflicts (Hockings, 2009).

Even though the use of ecosystem services is often criticized as promoting only utilitarian biodiversity values, it nonetheless provides an impetus for conservation that some find
attractive (Kangwana, 2013). We suggest, however, that there are a number of important asymmetries between management for biodiversity conservation and management for ecosystem services which make these synergies hard to attain and difficult to generalize.

According to the 2003 International Union for the Conservation of Nature (IUCN) World Parks Congress, human-wildlife conflict occurs when wildlife requirements encroach on those of human populations, with costs both to residents and wild animals (IUCN, 2005). Human-wildlife conflict has been in existence for as long as humans and wild animals have shared the same landscapes and resources (La Grange, 2005).

Human-wildlife conflict does not occur only in Africa. Nowadays human wildlife conflict exists in one form or another all over the world (Mensah, 2007). Conflict between humans and crocodiles, for example, has been reported in 33 countries spanning the tropics and subtropics, and the problem probably exists in many more. All continents and countries, whether developed or not, are affected by human wildlife conflict. However, there is an important distinction to be made between the level of vulnerability of agro-pastoralists in developing countries and that of well-off inhabitants of developed nations (Musiani, 2003).

In terms of the scale of their impact on humans, it is the smaller animals, occurring in vast numbers that have the greatest impact. The red locust has been responsible for famines across vast swathes of Africa for centuries. Annual losses of cereals caused by the red-billed quelea have been estimated at US$22 million (Vermeulen, 2004). In Gabon, the number of overall complaints about grass cutters far surpasses those relating to any other animal species, including the elephant (Werner, 1990).

However, the larger herbivores (elephants, buffalo and hippopotamus), large mammalian carnivores (lions, leopards, cheetahs, spotted hyenas and wild dogs), and crocodiles are traditionally seen as the animals representing the greatest threat to humans and responsible for the majority of human-wildlife conflicts (Rondeau, 2005). This may be due to the fact that local
communities often regard the large wild animals as government property, as was the case under previous colonial legislation, and therefore feel prohibited from dealing with the problem themselves (Ryszkowski, 2015; Ogada, 2004). The impact of the activities of large mammals on farmers and their livelihoods is enormous and even traumatic when people are killed. These incidents are often newsworthy, and generally attract the attention of political representatives who demand action from governments. Baboons can cause significant damage to timber forest plantations and are also considered a pest, notably in Southern Africa. For these reasons this survey deals with larger herbivores and carnivores, particularly animals that have been investigated in FAO studies, i.e. elephants, lions, baboons and crocodiles (Naughton 1998).

In Sub-Saharan Africa, the anthropogenic pressure on biodiversity is very high due to growing population density and poverty leading to conversion of much of the land for subsistence farming and exploitation of forest resources for fuel and building materials (Marker, 2015). Historically, conservation policies in Africa have favoured a fortress conservation approach, where people are excluded from the park and human encroachment is managed by legislation, law enforcement and some community education on the benefits of conserving natural resources (Hoare, 2010). However, many African countries have moved towards a more community based approach to conservation where conservation authorities allow local communities to access conservation areas for selective harvesting, share tourist and hunting revenues with local communities, jointly manage problems with wild animal crop raiding and livestock predation and help develop local agroforestry and agriculture to improve local livelihoods (Government of Namibia, 2007).

In Uganda, the ever-increasing human populations and conversion of forest to agricultural land mostly have a negative impact on wildlife by reducing and isolating habitat and ranging areas and increasing geographical and ecological overlap between humans and wildlife (Muhweezi 2014; Fischer, 2002). The nature of human–wildlife interactions varies but is often
characterized by increased resource competition and conflict, for example over crops (Delsink, 2003). Human–wildlife conflict is an important issue because it compromises conservation initiatives and threatens the economic and social security of rural people (Anderson, 2012). A cross-disciplinary approach to this issue could facilitate our understanding of the realities facing humans and wildlife and the sustainability of their relationships in anthropogenic habitats.

There has been a community-based biodiversity conservation approach (UWA, 2013). This involves initiatives aimed at conserving biodiversity in the park but also letting local people benefit from the park. Some of the initiatives involved in the community-based conservation approach include signing of resource use agreements such as in the Rwenzori Mountains National Park which allow local people who neighbour National Parks to have access to specific resources from the park for subsistence use (Muhweezi 2014). In other cases, local people are given money for infrastructural development, such as in Integrated Conservation and Development Initiative in Korup National Park in Cameroon. And in other National Parks such as Pendjari National Park in Benin, local people are given a percentage of revenue generated from tourism activities in the park.

Despite the implementation of these approaches, the Global Outlook 3 which is a recent report by the Secretariat of the Convention on Biological Diversity shows that biodiversity loss from protected areas has persisted (Mama, 2014). The report revealed that the targets agreed upon by leaders of different countries in the world in 2002 to significantly reduce the rate of biodiversity loss at global, regional, and national levels had not been met by 2010. Threats to biodiversity such as habitat loss, climate change, pollution, unsustainable use of resources, and invasive alien species have intensified (Mama, 2014; Hanks, 2006). According to Barakat, (2015) despite the many efforts taken around the world to conserve biodiversity and use it
sustainably, approaches and strategies so far have not been adequate to address the scale of biodiversity loss or reduce the pressures.

Establishment of conserved areas to protect biological resources in many ways can enable Uganda to earn local and foreign currencies through promoting the tourism industry (Mama, 2014; Muhweezi, 2014). It also prevents biodiversity from being destroyed by development and unsustainable land use activities. This is because the process of conservation involves restricting access to these lands for cultivation, pasture establishment, hunting and other livelihood activities. Promoting the conservation of these protected areas creates conflicts between conservation and other livelihood activities more especially agriculture in the communities adjacent to the protected areas.

1.2 Statement of the problem

Kibale National Park is surrounded by small scale farmers who entirely depend on subsistence agriculture for their livelihoods (Muhweezi, 2014). They grow crops like maize, finger millet, Sweet/Irish potatoes, bananas and cassava which are very palatable to most wild game (FAO, 2008). Though these protected areas have indirect ecosystem values (as protecting watersheds, climate etc) which are referred to as “Non-consumptive values”, the population surrounding these areas may not acknowledge them when the protection of such areas comes to crossroads with other livelihood activities (UWA, 2013). Despite the increasing efforts to guard against and limit the damaging effects of wild animals, most of the crop farming communities have remained vulnerable to crop raiding around Kibale National Park.

This has led to human–wildlife conflicts associated with increased crop raids and wildlife animal killings around protected areas. Many of the conflicts are counterproductive and destructive. One of the reasons for the increased crop raiding activities could be due to the ever-increasing population of the wild animals which results in exhaustion of their food resources hence they end up in the neighboring agricultural fields in search of food, in so doing, they
increase crop raiding activities. This therefore implies that subsequent losses by farmers may create antagonistic and intolerant behavior of the neighboring communities towards wildlife protection (Muhweezi 2014). It was therefore inherent that individual farmers or the entire community have to adopt coping mechanisms to such conflicting situations more so crop raiding (Mama, 2014).

This study was done in villages along the Western parts of Kibale National Park covering the parishes of Kiko, Kyanyawara and Nyabubale, in order to examine conflicts between biodiversity conservation and agriculture. Additionally, the study identified sources, triggers and impacts of conflicts on agriculture and wildlife conservation. The study further explored the defense methods and coping strategies applied by farmers to deter the adverse effects of wild animals on agriculture.

1.3 Objectives of the study

1.3.1 Overall objective

The overall objective of the study was to examine the impacts and effects of biodiversity conservation on agriculture in the fringes of Kibale National Park, with evidence from Kiko Town Council.

1.3.2 Specific objective

i) To determine the factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park.

ii) To investigate how farmers cope with the effects of conflicts arising from biodiversity conservation in the fringes of Kibale National Park.

iii) To determine the perception of crop farmers towards the conservation of biodiversity resources in Kibale National Park.
iv) To identify alternative methods of biodiversity conservation that can allow co-existence with farming activities.

1.4 Hypotheses

1. There are significant conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park.
2. Farmers have significantly coped with the effects of conflicts arising from biodiversity conservation.
3. Farmers have positive perceptions towards the conservation of biodiversity resources.

1.5 Significance of the study

The research findings will contribute to finding appropriate solutions to the park management about improving the mechanisms that can mitigate the effects arising from the conflicts between biodiversity conservation and agriculture. The findings from the study will lead to the generation of information and knowledge about the strategies to improve the protection of the crop farms.

1.6 Limitations of the research

Respondents asked for money in exchange of information. Therefore, there was a need for a thorough explanation that the study being conducted was purely academic and not for economic purposes and that students were not provided with money to exchange for information.

The study area being a famous research zone for different level researchers including the international agencies, different studies had been conducted in the same community by other researchers. Therefore, collection of data from same respondents on the same study
phenomenon was seen as boring to the respondents which in turn led to production of biased data.

1.7 Scope of the study

1.7.1 Geographical scope

The study was carried out in Kiko town council, neighbouring Kibale National Park in Kabarole district. The park lies at 00 30N, 30 24E.

1.7.2 Content scope

The study examined the conflicts between biodiversity conservation and agriculture. The main study purpose was to investigate the extent to which the crop farming communities are vulnerable to the effects of problem animals in the fringes of Kibale National Park, as evidenced from farming community of Kiko town council. The study concentrated on the extent of and factors leading to the conflicts between conservation and agriculture, crop farmers’ ability to mitigate the results of the conflicts and perception of the crop farming community towards protected area conservation.

1.7.3 Time scope

The study considered data from other authors obtained for a period 15 years that was from 2000 to 2015. The researcher used data obtained for period of 15 years because he believed it was enough to provide statistical evidence and observations.
1.8. Conceptual Model

![Conceptual Model Diagram]

**Independent variable**
- Situation analysis
  - Raids of animals
  - Damage to crops
  - Illegal hunting
  - Biodiversity destruction
  - Human encroachment
  - Loss of income
  - Livelihood losses

**Intervening variables**
- Laws and regulations
- Supportive policies
- Supportive infrastructure
- Organized farmers’

**Coping mechanisms**
- PatROLS by game rangers
- Information sharing
- Conflict management
- Control to encroachment
- Enactment of byelaws

**Dependent**
- Improved co-existence
  - Controlled raids
  - No or less crop damage
  - Better crop yields
  - Better livelihoods
  - Better biodiversity
  - Safety

**Situation analysis**
- Raids of animals
- Damage to crops
- Illegal hunting
- Biodiversity destruction
- Human encroachment
- Loss of income
- Livelihood losses

**Figure 1: Theoretical framework**
From figure 1: above the study was about coping with the conflicts between agriculture and biodiversity conservation in Kiko town council in the western parts of Kibale national park, Kabarole district. The study looked at biodiversity conservation as the dependent variable and coping mechanisms as the independent variable. Conflicts between biodiversity conservation and human activities were becoming increasingly apparent all over the world. The intensification of agricultural and silvicultural practices and other land uses are all potential threats to biodiversity that are leading to conflicts between stakeholder livelihoods and biodiversity conservation (Fliesbach, 2016).

Human-wildlife conflict (HWC) has existed for as long as humans and wild animals have shared the same landscapes and resources. However, currently, wildlife habitats are fast becoming human-dominated, which means that more wild species are compelled to exploit new human resources to survive. HWC results in negative impact on people or their resources, and wild animals or their habitat.

HWC is among the most important threats to the survival of many wildlife species. In Uganda and other developing areas of the world, fast growing human population and settlements accompanied by habitat fragmentation are reducing the wildlife habitats (Butler, 2000). As a result, there is an increase in the interactions between humans and animals. For example, transforming natural landscapes of the earth from predominantly wild to anthropogenic has created competition between humans and wildlife for space and resources and it has reached unprecedented levels.

A wide variety of wildlife comes into conflict with farming activities for search of human resource which causes crop damage and wildlife mortality. The major types of wildlife damage on the human being are predation of domestic animals, crop damage and sometimes killing of humans. The number and type of damage caused by wildlife varies according to the species, the time of year, and the availability of natural prey and crop raiding species (Mama, 2014).
To address the global decline in biodiversity there is, therefore, a need to identify the drivers responsible for conflicts between human activities and the conservation so as to promote the management of these conflicts. A multidisciplinary approach to conflict management must include active stakeholder involvement at every stage of conflict identification and management and other approaches like stakeholder dialogue and education, education and awareness, improvement in political and legislative frameworks, financial incentives, farmer group formations as well as planning infrastructure. Proper and effective management of Human-wildlife conflicts (HWC) results in controlled raids, no or less crop damage, better crop yields, better livelihoods and better biodiversity safety.

1.9 Operational Definitions

**Co-management:** Management shared between affected communities and governmental agencies or NGOs.

**Coping mechanisms:** Steps taken to reduce individual or household vulnerability, which range from individualized self-protection to collective insurance based on social reciprocity. The former depends heavily on individual access to land, labor, and capital, which depend in turn on wealth and political influence. By contrast, communal coping mechanisms depend on kinship networks, traditions of sharing, reciprocity, and joint land management.

**Local stakeholders:** Affected communities and the nationally appointed authorities charged with wildlife management at a site. While it can be a challenge to identify the appropriate unit of social organization to be involved in management, the natural and obvious unit is composed of the individuals and households affected by human-wildlife conflict in a given locality.

**Management:** Planning, intervention, and monitoring (including baseline applied research).

**Risk:** The likelihood of loss for a given locality. (Compare to “vulnerability.”)

**Vulnerability:** Individual or household capacity to cope with risk.
Wildlife: This brief focuses on terrestrial vertebrates (larger than one kilogram) rather than smaller organisms that typically produce greater economic losses, because larger organisms pose a greater immediate physical threat and provoke more political strife between environmental interests and other stakeholder groups.

CHAPTER TWO

2.0 REVIEW OF LITERATURE

2.1 Introduction

This chapter presents literature that was relevant to the study giving reference to the study objectives that were divided into three themes. The literature involved opinions and views of other scholars and researchers that were in line with the topic of study.

2.2 Definition of Human–wildlife conflict

Human–wildlife conflict is defined by the World Wide Fund for Nature (WWF) as "any interaction between humans and wildlife that results in negative impacts on human social, economic or cultural life, on the conservation of wildlife populations, or on the environment. “Human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife (Rodwell, 2010)."

A 2007 review by the United States Geological Survey defines human-wildlife conflict in two contexts; firstly, actions by wildlife conflict with human goals, i.e. life, livelihood and lifestyle, and, secondly, human activities threaten the safety and survival of wildlife (FAO, 2005).
The Government of Yukon defines human-wildlife conflict simply, but through the lens of damage to property, i.e. "any interaction between wildlife and humans which causes harm, whether it’s to the human, the wild animal, or property." Here, property includes buildings, equipment and camps, livestock and pets, but does not include crops, fields or fences (Ngantou, 2011).

2.3 Historical background of human-wildlife conflict

Human-wildlife conflicts have occurred throughout man's prehistory and recorded history. Amongst the early forms of human-wildlife conflict is the predation of the ancestors of prehistoric man by a number of predators of the Miocene such as saber-toothed cats, leopards, spotted hyenas amongst others (Barakat, 2015). Fossil remains of early hominids show evidence of predation; the Taung Child, the fossilized skull of a young Australopithecus africanus, is thought to have been killed by an eagle from the distinct marks on its skull and the fossil having been found amongst egg shells and remains of small animals (Bauer, 2013). A Plio-Pleistocene horned crocodile, Crocodylus anthropophagus, whose fossil remains have been recorded from Olduvai Gorge, was the largest predator encountered by prehistoric man, as indicated by hominid specimens preserving crocodile bite marks from these sites (Behnke, 2013).

The advent of farming and animal husbandry of the Neolithic Revolution increased the scope of conflict between humans and animals (Bullard, 2015). The crops and the produce formed an abundant and easily obtained food source for wild animals. Wild herbivores competed with domesticated ones for pasture. In addition, they were a source for diseases which affected livestock (Chetri, 2004). The livestock attracted predators which found them an easy source to prey on. The inevitable human reaction was to eliminate such threats to agriculture and domesticated animals. In addition, land was converted to agricultural and other uses.
and forests cleared, all of which impacted wild animals adversely. A number of animal species were eliminated locally or from parts of their natural range (Naughton 1998). The deliberate or accidental introduction of animals in isolated island animal communities have caused extinction of a large number of species.

2.4 Factors leading to conflicts between agriculture and biodiversity conservation

Musiani, (2003) argued that as human populations expand into wild animal habitats, natural wildlife territory is displaced. Reduction in the availability of natural prey/food sources leads to wild animals seeking alternate sources. Alternately, new resources created by humans draw wildlife resulting in conflict (Naughton, 1998). The population density of wildlife and humans increase with overlaps in geographical areas used increasing their interaction thus resulting in increased physical conflict. By-products of human existence offer un-natural opportunity for wildlife in the form of food and sheltered interference and potentially destructive threat for both man and animals. Competition for food resources also occurs when humans attempt to harvest natural resources such as fish and grassland pasture.

2.4.1 Human factors

The requirements of human development. The main cause of human-wildlife conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resources (Muhweezi, 2014). The transformation of forests, savannah and other ecosystems into agrarian areas or urban agglomerates as a consequence of the increasing demand for land, food production, energy and raw materials, has led to a dramatic decrease in wildlife habitats. This is particularly true in Africa where the human population came close to tripling in the four decades from 1960 and where, in consequence, settled agriculture has spread to more marginal rangelands leading to encroachment into wildlife habitats. Under these conditions, conflict between wildlife and local communities has
inevitably increased (Rodwell, 2010). This is perfectly illustrated by the conflict between humans and elephants. It is estimated that about 80 percent of elephant range lies outside protected areas. This habitat is rapidly being eliminated and fragmented by intensified agriculture, and is resulting in one of the most serious human-wildlife conflicts (Vermeulen, 2004).

*Migration of peoples for reasons of security or food safety.* Drought, floods, civil unrest, natural disasters or war disrupt the normal production and distribution of food, resulting in famines. This phenomenon is on the increase; the number of food emergencies in Africa each year has almost tripled since the 1980s. Across sub-Saharan Africa, one in three people are undernourished (Fischer, 2002). These factors spur the continuing migration of rural people into areas where resources could be obtained, and which are frequently occupied by wildlife. The resultant occupation of the habitat of wild animals by humans leads to conflict. War and civil unrest force people to seek shelter in protected areas where they exert a strong pressure on natural resources and enter into competition with wildlife.

*Specific activities.* Some activities particularly expose local populations to human-wildlife conflict. Growing interest in ecotourism and the increasing presence of humans in protected areas are exacerbating conflict between humans and wildlife. The local capacity to manage and regulate public access and large-scale use of protected areas is weak. Equally, tourists are unaware of the dangers of wild animals. Each year, tourists are killed or injured by elephants, crocodiles, lions or other wildlife species in protected areas (Fergusson, 2002).

**2.4.2 Habitat factors**

The gradual loss of habitat has led to increasing conflict between humans and wildlife. As wildlife range becomes more and more fragmented and wildlife is confined into smaller pockets of suitable habitat, humans and wildlife are increasingly coming into contact and in
conflict with each other. In the Kakum Conservation Area in Ghana, the forest area available to elephants has decreased by about half since the 1970s. This explains why the density of elephants (about 0.6/km²) is now higher than in most other West African forests, thereby resulting in increased crop-raiding activities (Cumming, 2012).

Nowadays, the last suitable habitats generally survive inside protected areas. This explains why conflicts are particularly common in reserve buffer zones where healthy wildlife populations stray from the protected area into adjacent cultivated fields or grazing areas.

In this respect, border zones of protected areas may be considered population sinks; critical zones in which conflict is one of the major problems (Cochrane, 2005). Several factors can contribute to the modification of the quantity or quality of wildlife habitats. The two most important factors are the following.

*Impact of human activities.* Human activities such as husbandry, agriculture, fishing, the development of infrastructure or even of tourism or wildlife protection itself, can dramatically modify wildlife habitats either directly or indirectly (Butler, 2000).

*Natural factors.* Droughts, bush fires, climatic changes and other unpredictable natural hazards can contribute to a decrease in suitable wildlife habitat and therefore affect the occurrence and extent of human-wildlife conflicts. Similarly, the seasonal modification of habitats due to rainfall can also have an impact on human-wildlife conflict (Barakat, 2015).

### 2.4.3 Natural characteristics of wildlife
The intrinsic characteristics of wildlife, such as food preferences, migration patterns, wariness or predation behavior, can influence human-wildlife conflict.

Some particularly palatable food items can attract wildlife over rather long distances. This is the case for some crops. For instance, according to Anderson, (2012), of the crops planted outside the Kakum National Park in Ghana, maize and cassava particularly attract elephants. Maize is also the crop most frequently raided in the area around the Djona hunting zone in North Benin. It is raided twice as often as cotton, and far more often than groundnut and millet (Ben-Shahar, 2009).

In Benin, elephants raiding maize and groundnuts were found to be attracted by mature wild fruits such as shea nuts (Vitellaria paradoxa) and Parkia biglobosa pods growing in the crop fields (Anderson, 2012; Chetri, 2004). Likewise, elephants are attracted by wild fruits growing alongside cultivated fruits such as mangoes (Mangifera sp.) or guavas (Psidium sp.) in central Burkina Faso (E. Compaoré, personal communication).

The species as well as the availability of wild prey can have an impact on potential human-wildlife conflict. A study in the United Republic of Tanzania (Hanks, 2006) showed that the number of humans attacked by lions in each district was closely linked to two factors: the abundance of medium-sized prey (zebras, hartebeest, dikdik or impala) and the abundance of bush pigs. Lion attacks were most common in areas where normal prey was scarcer and bush pigs were abundant (Hockings, 2009).

Species that migrate seasonally on a regular basis, such as elephants, are known to use the same traditional routes. Establishing cultivations along these routes exposes them to being raided. This has been observed for instance in Mali and Togo where the most serious damage occurred in villages located along the elephants’ habitual paths (Kangwana, 2013).
The wariness of wild species can explain why some fields are more prone to raiding than others. For example, baboons and monkeys tend to raid smaller fields surrounded by large trees and rocky hillocks, which provide cover for them (Kangwana, 2013). These vantage points provide them with easy escape routes and make it difficult for guards to follow them. On the other hand, when, for various reasons, wild species lose their fear of humans, this can also cause conflict. Elephant numbers have increased within many parks and reserves. Some individuals have grown accustomed to harmless contact with tourists, have lost their fear of people and will visit communities and destroy life and property (Musiani, 2003). Crocodiles are naturally wary of humans, especially in places where they are frequently hunted, but they can learn that people pose no threat. Food is a strong stimulus and a reward for learning; it is certainly possible for animals to acquire the habit of eating humans (Ogada, 2004).

A particular aspect of lion behavior known as “surplus killing” certainly exacerbates human hostility towards lions and enhances conflict. Like any other large felid species, once a lion breaks into a fenced enclosure it is often tempted to kill more – sometimes many more – domestic animals than it can eat (Rondeau, 2005). In addition, some lions become specialized and are chronic livestock killers (Werner, 1990).

Behaviorally, the Nile crocodile is an opportunist ambush predator which has evolved many physical attributes to optimize its success in this role. Adult crocodiles will feed on any animal they can capture or find animals that are freshly dead ranging in size from fingerling fish to a hippopotamus (Naughton 1998). Humans are less powerful and slower in water than any similar-sized wild mammal and are therefore easy prey.

2.4.4 Demographic factors

The expansion of human populations and large migrations are often partly responsible for agricultural biodiversity losses in new "frontier" areas such as forests, coastal zones,
mangroves and grasslands (Hoare, 2010). Whilst in some contexts population growth per se is clearly responsible for agricultural biodiversity loss, there are many situations in which inequitable land tenure, forest concession policies, colonization programs, land use and fishing policies are the root causes behind the biological diversity loss induced by growth in human numbers or migrations. Conversely, more people can mean more care for the environment and enhanced agricultural biodiversity under certain conditions, as shown by research in Sierra Leone (Musiani, 2003) and Kenya (La Grange, 2005).

2.5 Consequences of the human-wildlife conflict

The consequences of the human-wildlife conflict are more serious in the tropics and in developing countries where livestock holdings and agriculture are an important part of rural people’s livelihoods and incomes. In these regions, local people with a low standard of living are particularly at risk, as are agro pastoralists who depend exclusively on production and income from their land (Government of Namibia, 2007).

2.5.1 Safety issues

Injuries to people mostly occur as a result of chance encounters with elephants, buffalo, hippopotamuses and lions, usually along paths between dwellings and a water source. Contact with crocodiles when bathing or collecting water more frequently result in death than in permanent injuries, nevertheless many of these permanent injuries cause significant disability. The amputation of limbs is quite frequent, as are attacks that result in major scarring, often on the trunk (Fischer, 2002).

The dramatic consequences of these attacks go well beyond the unfortunate victim, for they have a repercussion on the whole community. At national level, the loss of a human life due to human-wildlife conflict has little consequence, but at the family and village level, it can be
catastrophic (Cumming, 2012). The death of a family member caused by a wild animal is a traumatic experience. For a poor peasant family in a developing country, the death or injury of the bread-winner can mean the difference between a secure life for all and one of destitution where simple day-to day survival becomes a priority. If a mother is killed, the child has to take her place in carrying out family chores and has lost the opportunity to receive an education. In time, this will have consequences for her children and their future (Crooks, 2002).

The danger of wildlife attacks restricts some activities considered “at risk” such as walking at night, guarding crops, bathing, etc. Security measures are then taken at the community level. In certain areas of Kenya, for example, such as Taita Taveta District that borders Tsavo National Park, curfews have been imposed on villagers to protect them from the uncontrollable movement of wildlife through villages and farms (Barnes, 2013).

2.5.2 Food security

In most of rural Africa, food security is precarious, relying intimately on the results of a single cropping season or on the sale of livestock (Bauer, 2013). Although on a national scale, the loss of two hectares of maize to elephants in a single night means nothing, to the family concerned, it can mean the loss of their food supply for the year, and the difference between self-sufficiency and destitution (Ben-Shahar, 2009). This consequence is particularly acute where governments do not have the capacity to pay compensation for losses. The capacity of smallholder subsistence farmers to cope with these losses can vary even within the same region. The owners of large farms situated on the edge of Kibale National Park in Uganda can employ guards or create a crop buffer zone to separate vulnerable yields from the forest edge, by cultivating less palatable plant species or using the land for pasture. These options are not available to subsistence farmers, who have less choice in their land use and cannot afford to pay for guards (Butler, 2000).
The elephant is one of the wild species that can jeopardize the livelihoods of entire families by causing substantial damage to crops. The impact of elephant raids can be dramatic, but other species cause more insidious losses (Chetri, 2004). In areas where subsistence agriculture is practiced, baboon raids on grain crops such as maize, sorghum and millet, as well as fruits and some vegetable crops can reduce the yield by a significant percentage. Around the Bénoué National Park in Cameroon, the species inflicting most of the crop losses are elephants, baboons, green parrots and warthogs (Crooks, 2002).

Likewise, the loss of a family’s small herd of cattle to lions can effectively destroy that family’s wealth and way of life (Bullard, 2015). For rural populations, domestic animals are not only their main resource through production of manure, milk, meat, and live sales, but are also their only source of wealth (means of saving, source of income, social role). Predators such as lions often kill numerous domestic animals such as cattle in one raid, and can devastate a household’s food security. In the Kanamub area of the Namibian Sesfontein Conservancy, farmers lose as many as three to four animals a month to lions, leopards, hyenas and cheetahs (Fischer, 2002).

The evidence relating to the direct competition for fish between crocodiles and humans is limited (Granli, 2006). Crocodiles consume about 0.5 percent of annual fish production or from 6 to 10 percent of the amount caught by artisanal fisheries. Most (about 67 percent) of these fish are scaleless non-commercial fish species avoided by subsistence and artisan fishers. On the other hand, crocodiles threaten food security by causing damage to fishing nets, particularly the thin monofilament gill nets with small to medium mesh size frequently used by artisanal fishermen. Hockings, (2009) reported that at Lake Kariba in Zimbabwe, over 80 percent of a sample of fishermen’s nets was damaged by crocodiles. The holes torn in the nets are often extensive – up to several metres in diameter. This reduces the fish offtake for the fishermen, and repairing or replacing the damaged sections requires significant amounts of time, effort and resources.
2.5.3 Economic and social costs Agriculture

*Agriculture.* Crop damage not only affects farmers’ ability to feed their families, it also reduces cash income and has repercussions for health, nutrition, education and ultimately development. When crop damage occurs, finances are diverted from these areas to cover the cost of staple foods (Hockings, 2009).

*Forestry.* Baboons stripping bark from exotic timber plantations may also have economic consequences. Although the loss of wood volume and value has been minor in economic terms, in Zimbabwe baboons have also damaged and raided non-timber forest products such as granadillas (passion fruit) or mushrooms which are inter-planted with the pine trees and provide a significant additional income (Mensah, 2007).

*Husbandry.* Mammalian carnivores and crocodiles are responsible for the loss of a high proportion of livestock throughout Africa. However, the number of livestock killed over a period of time is an inconsistent indicator in appraising the real impact on the livelihood of the rural population, and it would be more informative if it were related to the total family livestock holdings or total village units (Naughton, 1998). The quantification of economic losses should also be related to annual household incomes or the economic value of family holdings (such as cattle or agricultural fields) (Muhweezi 2014). The possibility of disease transmission from wildlife to livestock jeopardizes international trade. Cattle and/or meat can only be exported if they come from areas that are certified free of foot-and-mouth disease. This can only be done if the areas are free of buffalo.

*Infrastructure.* The economic cost of the damage caused by elephants to infrastructure in the Pama National Reserve in Burkina Faso would amount to about US$587/pond/year and US$23/track kilometre/year (Naughton, 1998).
Sports hunting. The Department of Wildlife and National Parks in Botswana placed a new ban on lion hunting for the 2008 season, because of its concern over the number of lions killed in defense of livestock in certain areas of the country (Ryszkowski, 2015). As a precautionary measure, the Department has taken the decision not to issue any lion hunting quotas until further notice. The Department wishes to assure the public that appropriate measures are being put in place to reverse the current trends (Rodwell, 2010). This hunting ban represents an important economic loss for the state and the hunting operators. In 2007, the trophy fee for a lion in Botswana was US$5 000 and the costs of a lion safari ranged from US$60 000 to US$92 000, depending on the duration of the safari.

Health and employment. Nuisance encounters with small animals, exposure to zoonotic diseases, physical injury or even death caused by attacks by large animals have high financial costs for individuals and society in the form of medical treatments. Nocturnal surveillance of fields results in a higher exposure to malaria (UWA, 2013).

2.6 Coping strategies with the effects of conflicts arising biodiversity conservation

Coping mechanisms range from individualized self-protection to collective insurance based on social reciprocity (Vermeulen, 2004). The former depends heavily on individual access to land, labor, and capital, which depend in turn on wealth and political influence. By contrast, communal coping mechanisms depend on kinship networks, traditions of sharing, reciprocity, and joint land management. The poorest, migrant households face compounding vulnerability. Without large landholdings or kin networks, they cannot buffer themselves from wildlife conflict, nor can they hire additional labor (Werner, 1990).

Some settings limit the use of social coping mechanisms (for example, recent migration by new ethnic groups, incentives for individual land ownership). Of course, a continuum exists from
individual to fully communal, social coping methods, and affected households may participate in both (Musiani, 2003).

Because HWC often leads to destruction of wildlife and wild lands or political clashes over biodiversity protection, outside groups often become involved. At that point, proposed solutions multiply and traditional coping methods may be forgotten (Marker, 2015). The risk in such cases is that traditional coping methods are often more understandable, sustainable, and cost-effective for affected households than are novel solutions advocated by stakeholders who are less directly affected by HWC. Moreover, the affected communities are sometimes wholly disenfranchised if wildlife authorities and outsiders step in to control HWC (La Grange, 2005).

To avoid the extremes either traditional, unregulated control of wildlife, which often spirals into unsustainable killing, or novel, technical solutions imposed upon affected peoples this brief focuses on co-management, including participation by affected households in decision-making, implementing experimental interventions, and even monitoring HWC (Hoare, 2010).

2.7 Perception of crop farmers towards the conservation of biodiversity resources

Attitudes and perceptions

In general, rural Africans have little sympathy for wildlife and see animals purely in terms of their meat value (Granli, 2006). This is illustrated by the fact that, in several Bantu idioms, the word Nyama used for wildlife also means “meat”. Rural communities consider wildlife, particularly large mammals, as threats to their safety and food security. This adverse perception is particularly strong near protected areas where the presence of wildlife populations inflicts daily costs on local communities, which can erode local support and tolerance. In turn, local people can develop a negative attitude towards reserves and wildlife, exacerbating conflict and undermining conservation efforts (Hanks, 2006).
Landowners, traditional land-users and even wildlife managers still sometimes deliberately kill species they consider a threat—from elephants to birds such as Quelea sp. with a view to reducing the population or even exterminating species within the locality (Fliesbach, 2016).

The continued negative attitude of communities towards wildlife emanates from losses (including human life, property, crops and even agricultural land set aside for conservation purposes) incurred by wildlife (Fergusson, 2002). The association of wildlife with damage is now so integrated in the minds of local populations that they will even blame beneficial species. In Zanzibar, for example, Cumming, (2012) found that red colobus monkeys, which villagers in agricultural areas adjacent to the Jozani Forest Reserve blamed for serious losses of coconut crops, actually increased final tree yields. By pruning away small, immature coconuts, they accounted for a 3 percent increase in the potential harvest. Primates are also a source of income in that they attract tourism.

Elephants seem to crystallize the hatred of rural communities. Field reports from across Africa describe local antipathy to elephants beyond that expressed for any other wildlife. People living in central African forests “fear and detest” elephants (Cochrane, 2005). Farmers in Zimbabwe display “ingrained hostility” to elephants, which are the “focus of all local animosity toward wildlife” (Wunder, 1997). Rural Ugandans complain bitterly about elephants, except where they have been eradicated (Crooks, 2002).

In the minds of most rural communities in Africa, lions are considered a pest that should be eliminated. In a study conducted in and around Queen Elizabeth National Park, Uganda, 37 percent of 156 respondents thought that the best way to deal with stray lions entering the village was to kill them; 35 percent said a fence should be erected around the protected area, and only 28 percent felt people should be taught how to avoid lions (Behnke, 2013). In Cameroon, of 236 herders questioned from 10 different villages along the borders of Waza National Park, 50
percent had a negative perception of lions (Barakat, 2015). In the Niger, 81.5 percent of 154 people questioned between 2000 and 2006 in 87 villages in the peripheral zone of the W trans boundary Park had a negative attitude towards predators, and 14 percent confirmed that they would kill predators (Barnes, 2013).

In some instances, the eradication of large carnivores has been linked to sports hunting and in others to systematic widespread elimination by trained agents (Ben-Shahar, 2009). Well known examples are the professional hunters who frequently kill wild dogs because they regard them as excessively cruel and efficient as predators. National veterinary services and herders will poison lions and hyenas in order to protect livestock development (Cochrane, 2005).

The tolerance level for human-wildlife conflict varies according to the species or the location. For example, African people have a complex but generally negative perception of crocodiles (Delsink, 2003). There seems to be almost no indigenous knowledge remaining about the role of crocodiles in the natural ecosystem, in contrast to the perceptions held by older generations concerning the roles of many terrestrial wildlife species (Anderson, 2012). Consequently, people simply see crocodiles as a threat and as a source of hardship because they attack livestock and compete for fish. However, there are a few exceptions, mostly linked to ancestral and totemic respect. These include the sacred crocodiles at Lakes Bazoulé and Sabou in Burkina Faso and other parts of French-speaking West Africa (Barnes, 2013). In these localities a human death or injury is better tolerated if it is caused by a crocodile rather than an elephant or a lion. In the first case people consider that it was the human who encroached on the habitat of the crocodile while, in the second case, the animal intruded into the human environment.

Local beliefs have an impact on the occurrence of some conflicts. As previously cited, attacks on human victims by crocodiles are often ascribed to witchcraft (Cochrane, 2005). The fatalism associated with witchcraft may, to some extent, explain the apparent lack of concern shown by
communities in their daily exposure to crocodiles. Described as “carelessness” by Cumming, (2012), this lack of any attempt to take even rudimentary precautions against attack, together with the repeated and frequent exposure to risk in the face of known and often recently demonstrated risk is difficult to understand. Fischer, (2002) refers to the same phenomenon in Kenya.

In rare cases, some local populations have a favorable perception of wildlife. Rural villagers who live close to the Waza National Park in Cameroon appreciate nature’s intrinsic value and agree with the need to protect forests and their wildlife inhabitants for future generations. Their positive attitude towards conservation arises from their use of natural resources, such as regulated harvesting of non-timber forest products, the use of waterholes and fishing (Hanks, 2006). In the United Republic of Tanzania, several villagers in the Rufiji district (which has experienced 92 lion attacks on humans since 1990) reported a high tolerance for lions because the lions helped to control the bush pig population (Fergusson, 2002).

2.8 Alternative methods of biodiversity conservation that can allow co-existence with farming activities

2.8.1 Human-wildlife conflict management

Human-wildlife conflict can be managed through a variety of approaches. Prevention strategies endeavour to avoid the conflict occurring in the first place and take action towards addressing its root causes (Chetri, 2004). Protection strategies are implemented when the conflict is certain to happen or has already occurred. Mitigation strategies attempt to reduce the level of impact and lessen the problem. The main difference between the options is the moment at which the measure is implemented (Cochrane, 2005).

2.8.2 Community awareness
Awareness raising can be carried out in the community at different levels, for instance in schools or in adult education arenas such as farmer field schools (Fischer, 2002). Educating children, coupled with awareness raising among adults through the traditional authority of chiefs and headmen, would certainly be highly cost-effective means of managing conflict (Hanks, 2006). Education and training activities could be directed towards disseminating innovative techniques, building local capacity for conflict prevention and resolution, and increasing public understanding of human-wildlife conflict. Educating rural villagers in practical skills would help them deal with dangerous wild animal species and acquire and develop new tools for defending their crops and livestock (Hockings, 2009). Over time, it would result in a change of behavior among local populations and would contribute to reduced risks, improvements in local livelihoods and a reduction in their vulnerability. In an optimistic scenario, education and training would promote commitment towards conservation, raise awareness of the essential role of wildlife in ecosystem functioning and its ethical and economic value, as well as its recreational and aesthetic importance (Kangwana, 2013).

2.8.3 Compensation

*Direct compensation.* The payment of compensation in the event of loss is usually confined to a specific category of loss, such as human death or livestock killed by predators or elephants. These schemes are often funded by a conservation organization, although government schemes also exist. All are designed to increase damage tolerance levels among the affected communities and prevent them taking direct action themselves, such as hunting down and killing the elephants, lions or other species involved (Kangwana, 2013). In sub-Saharan Africa, some compensation schemes for losses caused by wildlife exist. Furthermore, compensation programmes increase the return to agriculture and can therefore be viewed as a subsidy towards crop and livestock production. Such subsidies can trigger agricultural expansion and habitat
conversion, an inflow of agricultural producers from outside the affected areas, and ultimately, intensification of agricultural production (Marker, 2015).

**Insurance schemes.** The insurance scheme is an innovative compensation approach where farmers pay a premium for cover against a defined risk, such as livestock depredation. The premium can be set at the true market rate or be subject to subsidy provided by conservation organizations (Mensah, 2007). The method also requires an accurate assessment of the cause of crop damage, livestock depredation, human injury or death, but because it operates on a more local scale, reports can be more easily verified. Although the insurance scheme can impose certain practices which need to be undertaken by participating farmers to avoid human-wildlife conflict, overall the method seems promising. An example is the Human Animal Conflict Self Insurance Scheme (HACSIS) in Namibia (Naughton, 1998; Ngantou, 2011).

**Indirect compensation.** Alternative compensation systems rely on giving out licenses to exploit natural resources, through tourism, hunting or collecting fuel wood, timber, mushrooms, fodder, etc (Ryszkowski, 2015). This type of compensation scheme, also known as the “settlement of rights” to use natural resources, appears to be a more practical solution than monetary payment. Indeed, the benefits derived from the legitimate use of natural resources influence the attitudes and perceptions of rural residents (Rodwell, 2010). In Zimbabwe for example, crocodile eggs are collected from the wild by communities and sold to private crocodile farms. When communities receive a financial incentive, this increases their tolerance of crocodiles in the wild (Ngantou, 2011). Benefit-sharing can also be considered within this broader approach which provides tangible benefits to land owners in recognition of the role they play in hosting wildlife on their land and covering associated costs. In this way wildlife becomes a valuable resource rather than a liability (Werner, 1990).
2.8.4 Intensifying human vigilance

Vigilance is an important component of crop or livestock protection and human wildlife conflict management. The fear of humans normally dissuades animals from committing damage. In Kibale National Park in Uganda, elephants waited at the forest edge until farmers left the fields before they would enter (Vermeulen, 2004), suggesting an aversion to the presence of humans. Elephants in the area around the Kakum Conservation Area in Ghana appear to avoid farms where people are present (Hoare, 2010).

Guarding herds and taking steps to actively defend them are essential features of animal husbandry. Where herdsmen are present, the rate of depredation is generally lower than in free-ranging herds (Fischer, 2002). In East Africa, where human herders are effective and fearless in warding off predators, herdsmen are reported to challenge and scare away dangerous carnivores such as lions, hyenas and cheetahs with nothing more than simple weapons such as spears, knifes or firearms (Fergusson, 2002).

2.8.5 Guard animals

Guard animals provide an alternative to a herder monitoring a flock, which is labor-intensive, time-consuming and costly. To be successful, a guard animal must bond with the animals they are to guard. This bonding, combined with the guard animal’s natural aggression toward predators, can make a guard animal an effective protector (Fergusson, 2002).

Dogs can be effective in protecting homesteads and livestock from attack by predators. The dogs are trained to alert people to the presence of predators, rather than chasing predators (Bauer, 2013). These dogs are raised from puppyhood with sheep or cattle and live with the herd full-time. Several new training aids are now available to the dog handler including “shock collars” to provide stimuli to the animal in obedience training and are used in conjunction with
whistles and global positioning system (GPS) collars in the event of animals becoming lost (La Grange, 2005).

Donkeys have also been used as guard animals in many parts of the world. In some areas of Kenya one or two donkeys per herd of cattle have been used to guard against lions. Donkeys appear to have a higher defense instinct than cattle and are naturally more alert and aware of predators (Butler, 2000). They make formidable opponents, they are not afraid and will find predators and chase them away, even by biting and kicking. Mares with foals are particularly protective. Foals should be raised with livestock. However, stallions tend to break fences and become aggressive during breeding (Cochrane, 2005).

2.8.6 Fencing

If they are properly designed, constructed and maintained, fences can be almost completely effective in preventing conflict between people and wild animals. Fences are used to protect crops and to protect people and livestock (Barnes, 2013; Bauer, 2013). They are also used to insulate protected areas; communities seem increasingly to opt for separation rather than integration of culture and nature in the landscape, as a result of increasing human-wildlife conflict and scarce human involvement in or direct benefit from conservation. Fenced wildlife sanctuaries enable people to benefit, yet be separated, from wildlife, so that they can practice other land uses such as pastoralism and agriculture (Barakat, 2015).

Fences also help prevent the transmission of certain endemic contagious diseases such as foot-and-mouth disease, African swine fever and theileriosis. The establishment of control areas, game-proof fences, sanitary cordons and movement control to separate wildlife from domestic livestock has frequently given the best results (Chetri, 2004; Cochrane, 2005). This method has generally been used in countries with an advanced land-use policy where nomadic pastoralism is not practiced. It is less likely to succeed against endemic arthropod-borne infections such as
trypanosomiasis, epizootic hemorrhagic disease, African horse sickness, and Rift Valley fever, where vaccination and vector control may be required to reduce transmission (Ben-Shahar, 2009).

### 2.8.7 Agriculture

Little research exists on wildlife preferences for particular crops, but some crops are less palatable to wildlife (Cochrane, 2005). There are some crops that elephants appear not to eat. For this reason, alternative crops such as ginger and chili have been encouraged around Kakum National Park in Ghana. Several farmers who were considered to be in high-conflict areas have shifted from cultivating food crops to growing other crops such as cocoa and ginger to sell at the local market in Foso. It is possible to harvest 30 or so baskets of ginger from an acre of land. Each basket is worth a minimum of 60,000 cedis (¢); an acre of land can produce a total of ¢1 800,000 (US$205). These prices can double towards the end of the season. Growing chili peppers around the land has been encouraged in Namibia, in the Salambala Conservancy in Caprivi, where the first two sales of chilies in 2006 brought a total of US$925 to about 50 farmers (Butler, 2000), and in Zimbabwe where a programme to grow this crop for export was set up to raise income for farmers while also repelling elephants.

### 2.8.8 Husbandry

Livestock raids can be minimized through good husbandry practices, such as herding during the day, keeping livestock in a predator-proof enclosure at night or avoiding predators’ home territory (Cochrane, 2005). Additionally, a livestock keeper can remove thick cover from near animal holding areas. Equally herders should systematically avoid taking livestock to water points which are known to be inhabited by large crocodiles (Cochrane, 2005). Good husbandry also requires vigilance and a willingness on the part of the owner to confront predators when the need arises (Fergusson, 2002). This is a daunting task when the farmer is not properly
equipped for it, especially since confrontations usually occur at night. Farmers can actively manage their herds to protect them against depredation by controlling breeding times. By directing the movement of the bull, the farmer can plan and synchronize calving. This helps protect cows and their calves against carnivores during the days and months in which they are most vulnerable to depredation, and means that animal protection can be seasonally managed (Fliesbach, 2016).

2.8.9 Translocation

Translocation consists of moving a certain number of animals from a problematic zone to a new site. In spite of the risk of exporting the problem to another site, it may be a practical and politically correct approach in some cases, especially where suitable habitats with territorial vacancies are available (Fliesbach, 2016). In some situations, translocation can be a pre-emptive action before human-wildlife conflict occurs. For instance, the presence of a lion in a cattle ranching area or large crocodiles in water bodies close to human habitation can often be detected before the animals have caused a problem (Mensah, 2007). These potential problem causing animals can then be removed and trans-located before they kill livestock or people. In addition, the sale of live animals to private reserves or crocodile farms can provide additional income. This technique has been used more or less successfully with elephants, crocodiles and other carnivores. Trapping and trans-locating baboons is feasible and can potentially provide an immediate solution to the bark-stripping problem within the troops range (Kangwana, 2013).

2.9 Study gaps

Although many studies have been conducted on threats that protected areas face, there is a scarcity of literature that assesses why those threats have persisted. In addition, there is a scarcity of published literature that analyzes why some strategies aimed at preventing biodiversity loss succeed in some instances and fail in other instances. In the absence of such
literature, it becomes difficult to propose other strategies or to have a basis upon which new ones can be improved.

Although the Secretariat for the Convention on Biological Diversity identified underlying causes to biodiversity loss such as demographic change, economic activity, levels of international trade, per capita consumption patterns linked to individual wealth, cultural and religious factors, and scientific and technological change, these factors were not discussed in specific detail in the context of conserving biodiversity in National Parks in Africa. In this paper, the aim is to identify alternative methods of biodiversity conservation that can allow coexistence with farming activities.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter outlines the methods that were applied in conducting research. It included; the study design, study area, study population, sample size determination, sampling procedure,
selection of study participants, data collection instruments, quality control and data management and analysis, eth

3.2 Study Design

To realize the study objectives, the study employed a cross sectional study design where both quantitative and qualitative data collection techniques were used. These methods were used for purposes of drawing valid conclusions. The design was chosen because the study intended to select respondents across different communities with the purpose of soliciting for their opinions and analyzing them for comparison. This enabled flexibility in the study while the researcher achieved a deeper understanding of the respondents’ world. Their facts and opinions further enabled the researcher to find out appropriate recommendations as there are listed in the proceeding chapters.

3.3 Area of study

The study was conducted in selected villages of Kiko Town Council. Muhweezi (2014) reports that “being the closest town council to Kibale Nation Park, most farmers in Kiko town council had experienced frequent crop raiding”; it was for this reason that this town council had been considered proper for providing reliable data on examining the extent and causes of conflicts between biodiversity conservation and agriculture in the farming communities surrounding fringes of Kibale National Park. The town council is found in Burahya County, Kabarole District. It is bordered by Busoro Sub County (Kaswa village) in the North, Ruteete Sub County (Rurama village) in the South and Buheesi and Fort Portal municipality in West and Kibale National Park in the East. Kiko Town Council is comprised of four wards: Kiko, Kasisi, Kyanyawara and Nyabubale, giving a total of 10 villages/cells. According to the provisional results of the 2014 National Population and Housing Census (NPHC) released in November 2014; Kiko Town Council has 3011 households, average family size of 4 and a total population of 11,972 (6,058 males and 5914 and females).
3.3 Study population

The study comprised of (412) respondents and these included local community members, local leaders and staff from Uganda Wildlife Authority (UWA). Of these, 137 respondents were selected from each of the three (3) sampled parishes that were studied. The parishes and villages studied were purposively picked depending on their closeness to the National Park.

3.4 Sampling procedure

Kiko town council was purposively selected basing on the complaints that were raised by the farming communities of Kiko town council. The sampling unit was a household and the 2014 National Population and Housing Census (UBOS, 2014) was referred to determine the sample size. The sampling frame was the village mapping for the 2014 National Population and Housing Census (UBOS, 2014). The village level was divided into two. The first division consisted of the villages (i.e., Nyabubale & Nyabinamba) that were very close to Kibale National Park; the second division consisted of those villages (i.e., Kanyambeho A & Kanyambeho B) that were far from the National Park; this was done to carry out a comparative analysis. The villages were purposively selected depending on their proximity to the national park.

Table 1: Distribution of sample households to be interviewed during the study.

<table>
<thead>
<tr>
<th>Villages</th>
<th>Number of Households</th>
<th>Sample Proportion</th>
<th>No. of households to be Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kanyambeho A</td>
<td>194</td>
<td>194/863 x 412</td>
<td>93</td>
</tr>
<tr>
<td>Kanyambeho B</td>
<td>160</td>
<td>160/863 x 412</td>
<td>76</td>
</tr>
<tr>
<td>Nyabinamba</td>
<td>227</td>
<td>227/863 x 412</td>
<td>108</td>
</tr>
<tr>
<td>Nyabubale</td>
<td>282</td>
<td>282/863 x 412</td>
<td>135</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>863</strong></td>
<td></td>
<td><strong>412</strong></td>
</tr>
</tbody>
</table>
Simple random sampling technique was used to select the households that were studied.

3.5 Research instruments

The research instruments used for data collection included; questionnaire, interview schedule and direct observation.

3.5.1 Questionnaires

Semi structured questionnaires were employed to obtain qualitative and quantitative data from farming households. Section A constituted the respondents’ background information such as gender, level of education and village, while section B comprised of the varying questions. The questionnaires facilitated the respondents to express their opinions on the factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park; how crop farmers had cope with the effects of conflicts, farmers’ perception towards the conservation of biodiversity resources and the alternative methods of biodiversity conservation to allow its co-existence with farming activities.

3.5.2 The interview Guide

This involved oral questioning to facilitate face to face interaction with respondents. The interview guide was used to direct key questions with key informants such as Uganda Wildlife Authority (UWA) staff and local leaders who were purposively identified for the study to answer specific questions.

3.5.3 Observation

During the interview sessions, the researcher observed and took pictures of the respondents’ gestures and expression in their farms as well as ascertained the level and type of conflicts especially relating to property/field damages. Additionally, farms were visited to ascertain the magnitude of crop damage and distance from the park boundary. This helped in getting actual data through assessment to avoid farmers’ exaggeration in anticipation for compensation
package. Observation method was further used to identify a particular problem including the animal species responsible for the conflicting with the community livelihoods.

3.6 Data Quality Control

3.6.1 Content validity
To establish content validity of instruments, the researcher consulted experienced and skilled researchers including the supervisors. The researcher then piloted a questionnaire before finally administering it to test its validity. Validity of the questionnaires was determined by pre-testing the instruments. Pretesting was done by administering questionnaires to two (2) respondents within the study population but outside the sample. Results from the field helped to identify gaps and make modifications to the instruments, where necessary.

3.6.2 Reliability of instruments
To ensure quality of this study, the researcher took a number of measures during the field work, analysis and conclusion process. Before real collection of data, data instruments were pre-tested on 2 respondents from each group to determine their reliability and these respondents were not among the interviewers. Reliability of the questionnaires in relation to the consistency of the respondents’ answers was computed using the Cronback’s Alpha Coefficient reliable and was over 0.70.

3.6.3 Confidentiality
The main ethical principles in research included issues such as no harm to respondents, informed consent, privacy and confidentiality, cooperation, competence of researchers and publication of findings. The researcher applied all these ethical principles.

3.7 Data Analysis and management
The data collected was entered into Microsoft Excel version 2007 to ease data management and remove errors after which was transferred to a Statistical Package for Social Scientists (SPSS) version 20 for further data management.
Quantitative Data Analysis

This involved processing of the data at three levels using SPSS version 20. The levels included; Univariate, Bivariate and Multivariate analysis.

Univariate analysis:
Techniques for summarizing continuous data were used like mean, variance and standard deviation while frequencies and percentages were used for categorical variables.

Bivariate analysis
Cross tabulations was used to test any possible associations between each of the independent variables and the dependent variable. Statistically significant relationships were determined at p-values (p<=0.05) and all significant variables at this level were considered at multivariate level analysis.

Bivariate analysis was done using Pearson’s chi-square test. The chi-square test statistics ($X^2$) in the form of,

$$(x)^2 = \sum_{i=1}^{r} \sum_{j=1}^{c} 1 \left( \frac{O_{ij} - E_{ij}}{E_{ij}} \right)^2$$ ...

Where $X^2 = $ Chi-square; $O_{ij}$ = the observed frequency is the $i^{th}$ rows and $j^{th}$ column.

$E_{ij}$ = The expected frequency in the $i^{th}$ rows and $j^{th}$ column.

Chi-square will be tested at 0.05 level of significance

$i = 1 \ldots \ldots \ldots \ldots \ldots r$

$j = 1 \ldots \ldots \ldots \ldots \ldots c$

Multivariate analysis
Multivariate analysis was performed to assess the factors that are closely associated with the dependent more than the others. The dependent variable was categorical with more than two
categories. The model used to analyze this kind of dependent variable was multinomial logistic. Multinomial logistic model was used because it attempts to control for possible cofounding effect of independent variable on each other and thus finding the individual association for each independent variable with dependent variable.

\[
\log \left( \frac{p_{ji}}{P_1} \right) = a_i + \beta_j x_i + b_2 x_2 + b_3 x_3 = \cdots 3.2
\]

Where: \(a_i\) - represents the constant

\(p_j\) - represents the probability of the \(j^{th}\)

\(\beta_j\) – Regression coefficients

\(x_{ij}\) – independent variables

\(P_1\) – Prob. of the base category

**Qualitative Data Analysis**

Data from interviews was analyzed by thematic content analysis. The data was coded and categorized and common themes were identified. Analysis of perceptions and attitudes of farmers towards the factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park was done.

**3.8 Anticipated Study Limitations and Delimitations**

The study was limited by the following by the following obstacles:

- Suspicion of some respondents- Some respondents became reluctant in giving out information about the study asking why the research particularly aimed at conflicts between agriculture and biodiversity conservation in Kiko town. This was solved by ensuring such respondents that information given was for academic purposes and would be treated with utmost confidentiality.

- Hard to trace - Some respondent’s especially farmers and the key informants caused some delays in answering questionnaires because most of them were a way in the gardens and
workshops. This was however solved by appealing to them for maximum cooperation. The researcher made prior appointments with them by getting their phone contacts.

Lack of enough funds to successfully carry out the study- The money needed for producing the work in form of typing, printing, photocopying and binding was quite a lot. This hampered the effort to collect data in time as it constrained the researcher. This was dealt with by use of some willing classmates and friends to freely volunteer in the exercise to accomplish the report in the required time provided by the University.

The researcher faced a challenges of getting adequate information from different study sources like text books, novels and journals. The researcher spent a lot of his time looking for the literature review which was a bit tiresome. Even, the available literature for this kind of study was very scarce since it had not been fully researched by many scholars.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter presents the findings of the study. These are the findings which answer the research questions that were put up basing on the research objectives. The objectives of the study were to determine the factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park, to investigate how farmers cope with the
effects of conflicts arising from biodiversity conservation, to determine the perception of crop farmers towards the conservation of biodiversity resources and to identify alternative methods of biodiversity conservation that can allow co-existence with farming activities.

4.2 Demographic characteristics of the respondents

Table 2: Gender of the respondents

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>240</td>
<td>58.3</td>
</tr>
<tr>
<td>Female</td>
<td>172</td>
<td>41.7</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The analysis of the findings summarized in table 4.1 indicate that majority (58.3%) of the study respondents were male and (41.7%) were female.

Table 3: Age of the respondents

<table>
<thead>
<tr>
<th>Age in years</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>412</td>
<td>15</td>
<td>56</td>
<td>28.76</td>
<td>7.426</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>412</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Findings indicate that the youngest study respondent was 15 years old and the oldest had 56 years, on average majority of the respondents were aged 28 years (28 + 7). Those aged 28 years and below formed the largest number of respondents.
The analysis presented in the table that majority 55.8\% of the respondents were married, 15.3\% were never married, 9.7\% were separated 9.2\% had divorced, 5.3\% were cohabiting and only 4.6\% were widows.

Table 4: Education of the respondents

<table>
<thead>
<tr>
<th>Educational level in years</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid N (list wise)</td>
<td>412</td>
<td>1</td>
<td>16</td>
<td>5.62</td>
<td>4.141</td>
</tr>
</tbody>
</table>

The analysis of the findings in the table above indicate that the respondent with the lowest level of education had primary one and the high education qualification was a degree (16 years), on average majority had attained primary five.
From the analysis of the results, it is shown that majority 92.7% of the respondents were farmers, 4.4% were local leaders and 2.9% were UWA staff.

Table 5: Employment Status

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Employed</td>
<td>116</td>
<td>28.2</td>
</tr>
<tr>
<td>Self-employed</td>
<td>275</td>
<td>66.7</td>
</tr>
<tr>
<td>Unemployed</td>
<td>21</td>
<td>5.1</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

From the analysis of the results, it is indicated that majority 66.7% of the respondents were self-employed, 28.2% were employed and 5.1% were unemployed. Among those that were self-employed, 73% were directly involved in farming and other farming related activities and 18% were doing business.
Results on marital status indicate that 54.5% of the total study participants were married, 41.7% single and 3.8% had separated.

4.3 Factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale national park

Table 6: Factors leading to conflicts between agriculture and biodiversity conservation in the fringes

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>.613</td>
<td>.120</td>
<td>.623</td>
<td>5.130</td>
</tr>
<tr>
<td></td>
<td>.001</td>
<td>.031</td>
<td>.002</td>
<td>.044</td>
</tr>
<tr>
<td></td>
<td>.002</td>
<td>.004</td>
<td>.048</td>
<td>1.120</td>
</tr>
<tr>
<td></td>
<td>.021</td>
<td>.004</td>
<td>.247</td>
<td>5.554</td>
</tr>
<tr>
<td></td>
<td>.015</td>
<td>.013</td>
<td>.305</td>
<td>.117</td>
</tr>
<tr>
<td></td>
<td>.054</td>
<td>.010</td>
<td>.307</td>
<td>5.177</td>
</tr>
<tr>
<td></td>
<td>.050</td>
<td>.008</td>
<td>.293</td>
<td>6.525</td>
</tr>
<tr>
<td></td>
<td>-.025</td>
<td>.009</td>
<td>-.173</td>
<td>-2.802</td>
</tr>
<tr>
<td></td>
<td>-.007</td>
<td>.017</td>
<td>-.175</td>
<td>-3.860</td>
</tr>
<tr>
<td></td>
<td>.052</td>
<td>.010</td>
<td>.239</td>
<td>4.933</td>
</tr>
<tr>
<td></td>
<td>.016</td>
<td>.016</td>
<td>.060</td>
<td>1.058</td>
</tr>
</tbody>
</table>
a. Dependent Variable: Whether there are factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale national park (Yes=1 otherwise =0) significant at 1 and 10%, respectively.

Gender had no significant influence (p=.965) on the conflicts between agriculture and biodiversity conservation in the fringes of Kibale national. Both male and females in the area are involved in farming activities which places biodiversity at a risk of degradation.

Age of the household members on the community had no significant (p=.263) influence on the conflicts between agriculture and biodiversity conservation in the fringes of Kibale national.

Educational level had a significant influence (p=.000) on the conflicts between agriculture and biodiversity conservation. The more the level of education of household members increases the likelihood that a member understands the benefits of biodiversity conservation. People who never went to school were reported to involve illegal activities such as poaching for food and survival as well as encroaching on park land for agriculture, such activities have been recorded to have a negative impact on biodiversity conservation.

The distance between garden and the park had a significant influence (p=.001) on the conflicts that occur between human activities like agriculture farming and biodiversity conservation.

Wild life animals like elephants, monkeys, baboons and birds usually invade crop gardens near the park eating crops like maize, paws, cassava, sorghum and millet. On the other hand, humans retaliate either by chasing the animals away or by killing them.

Type of crops growth had a significant influence (p=.000) on raids by a number of wild animals. Elephants, baboons, monkeys, and birds are known for their different tests for example elephants are like testing paw paws, bananas and maize, therefore growing such crops in the fringes of the park, increases the risk of facing raids on those particular crops by the animals.
Type of animals reared in the vicinity were significantly influenced \((p=.000)\) in the war between wild life and agricultural. Animals like lions, wild cats, hyenas, wild dogs, pythons, reptiles are known to attack livestock like goats, cattle, sheep and at times human beings. On the other hand, eagles attack birds including ducks and hens leaving loses. In the due process human beings act back by killing the animals to safe guard their livestock hence escalating the human wildlife conflict.

Poaching and related activities had a significant influence \((p=.005)\) on the conflicts between agriculture and biodiversity conservation. Poaching is a practice that involves killing of wild birds and animals to support food security and incomes of the hunting households. The number of households and individuals involved in hunting activities along the park have significantly impacted on biodiversity by reducing the number of animals and birds yet these wild creatures play a big role in the ecosystem.

Other human activities like charcoal burning, crop farming and animal production significantly led \((p=.000)\) to human-biodiversity conflicts. Charcoal burning involves cutting down of trees which causes displacement birds and reptiles. Also the process of charcoal burning leaves soil organisms displaced and burnt hence limiting their role in soil formation. On the other hand, crop farming and animal production has accelerated on the encroachment on park land hence leading to the displacing of animal habits from both inland and swamps.

![Figure 4: Types of crops grown](image-url)
The analysis of the findings presented in the table above indicates that there are different crops grown in Kiko town council in the western parts of Kibale national park, Kabarole district. Among the crops commonly grown, beans 22.3%, maize 20.1%, cassava 14.3%, banana 12.6%, vegetables 12.4%, vegetables 12.4%, millet 10.9% and sorghum 7.3%. Seasonal crops are the most commonly grown as compared to perennial crops. These are usually produced under intercropping system because of limited land in the area, the cool climate characterized by two rainy seasons has always boosted production in the area.

4.4 Farmers coping strategies with the effects of conflicts arising biodiversity conservation in the fringes of Kibale national park

Table 7: How the community responds to the wildlife animals that attack animals and crops

<table>
<thead>
<tr>
<th>Valid</th>
<th>Report to Park Authorities</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Report to Park Authorities</td>
<td>112</td>
<td>27.2</td>
</tr>
<tr>
<td></td>
<td>Physical guarding of gardens and domestic animals</td>
<td>33</td>
<td>8.0</td>
</tr>
<tr>
<td></td>
<td>Lighting fire in the garden at night</td>
<td>101</td>
<td>24.5</td>
</tr>
<tr>
<td></td>
<td>Shifting from homes to gardens in temporary housing structure</td>
<td>22</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>Snaring/Killing</td>
<td>37</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Alert the neighbors</td>
<td>21</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>Planting less palatable crop species</td>
<td>23</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>Nothing is done</td>
<td>63</td>
<td>15.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The analysis in the table above presents the ways on how farmers in the fringes of Kibale national park have responded to the wildlife attacks crops and domesticated animals, findings indicate that 27.2% of the respondents did respond by reporting the cases to the Park Authorities, 24.5% lit the fire to scare animals from reaching the garden, 15.3% had nothing to do other than watching the animals destroy the crops, 9% reacted by snaring and killing the attackers, 8% physically guarded their crop gardens and domestic animals, 5.6% usually plant
less palatable crop species that attract wildlife, 5.3% shifted from homes to gardens in temporary housing structure to guard crops against attacks and only 5.1% alerted the neighbors.

Table 8: Help community receives from Uganda Wildlife Authority to cope up with the arising conflicts in the area

<table>
<thead>
<tr>
<th>Valid</th>
<th>Gazzeting and protecting the prone areas</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Educating and training the community on techniques of chasing away animals whenever they attack</td>
<td>128</td>
<td>31.1</td>
</tr>
<tr>
<td></td>
<td>Providing the community with chemical elements that repel wild animals</td>
<td>75</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Compensating households for the crops destroyed and animals killed</td>
<td>53</td>
<td>12.9</td>
</tr>
<tr>
<td></td>
<td>Encouraging the community to plant or raise animals far away from wildlife</td>
<td>24</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>Supporting the affected households</td>
<td>57</td>
<td>13.8</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

From the analysis, 100% of the respondents accepted that Uganda Wildlife Authority has helped the community cope with the arising conflicts in the area, 31.1% received education and training on techniques of chasing away animals whenever they attack, 18.2% reported that UWA has gazzeted and enclosed part of the park near their crop gardens, 18% were provided with chemical elements that repel wild animals, 13.8% were supported UWA after attacks, this supported was in form financial compensation for the crops and animals attacked or paying medical bills for attacks on human beings. 12.9% of the respondents had been compensated for the crops destroyed and animals killed and only 5.8% were encouraged by UWA to plant more trees and always raise their animals in a distance away from wildlife.

4.5 Perception of crop farmers towards the conservation of biodiversity resources

Table 9: Farmers perceived benefits of conserving the biodiversity resources
From the analysis of the findings presented in the table above, 90.3% of the respondents agreed that it was important to have protected areas for wild animals especially near the crop gardens and livestock systems. Among the highlighted reasons for having the park land protected in some areas, 29.1% was to minimize crop and animals losses that result wild animal raids, 17.7% was to stop on the encroachment of park land by the community, 14.8% was to protect against the conflicts that are likely to exist between agriculture farming and biodiversity conservation, 13.3% minimizing attacks on human beings by wild animals, 13% was to minimize the spread of pests and diseases especially among animals that share the same family like cattle and buffaloes as well as goats and antelopes and 11.7% guarding against eco-system degradation.

Table 10: Benefits of conserving the biodiversity resources
<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimizes crop raids and domestic animal killings</td>
<td>68</td>
<td>16.5</td>
</tr>
<tr>
<td>It protects against environmental degradation</td>
<td>111</td>
<td>26.9</td>
</tr>
<tr>
<td>It conserves the eco-system and its functions</td>
<td>104</td>
<td>25.2</td>
</tr>
<tr>
<td>To boost production and productivity</td>
<td>72</td>
<td>17.5</td>
</tr>
<tr>
<td>To protect against climate change and global warming</td>
<td>57</td>
<td>13.8</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The analysis in the table above indicated that conserving the biodiversity resources protects against environmental degradation by 26.9%, conserves the eco-system and its functions by 25.2%, boosts agricultural production and productivity by 17.5%, minimizes crop raids and domestic animal killings by 16.5% and offers 13.8% protection against climate change and global warming.

4.6 Alternative methods of biodiversity conservation that can allow co-existence with farming activities

From the analysis of the findings in the table above 88.8% of the respondents revealed that there are many chances of farmers living with animals, however 11.2% refuted the statement citing that wild animals were dangerous to humans and agriculture farming since they could easily attack both humans and domesticated animals as well as cause losses through crop raids.

Table 11: Methods of biodiversity conservation that can allow co-existence with farming activities
<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopping the encroachment of national park land</td>
<td>96</td>
<td>23.3</td>
</tr>
<tr>
<td>Protecting and Gussetting national parks and game reserves</td>
<td>35</td>
<td>8.5</td>
</tr>
<tr>
<td>Eliminating poaching activities</td>
<td>57</td>
<td>13.8</td>
</tr>
<tr>
<td>Relocating destructive wild animals from the areas that are most affected</td>
<td>37</td>
<td>9.0</td>
</tr>
<tr>
<td>Encouraging communities to plant trees</td>
<td>27</td>
<td>6.6</td>
</tr>
<tr>
<td>Eliminating bush and charcoal burning activities near and around protected areas</td>
<td>40</td>
<td>9.7</td>
</tr>
<tr>
<td>Strengthening biodiversity laws and policies</td>
<td>19</td>
<td>4.6</td>
</tr>
<tr>
<td>Creating awareness in the community about the benefits of biodiversity conservation</td>
<td>38</td>
<td>9.2</td>
</tr>
<tr>
<td>Strengthening the ties between the community and Uganda wildlife authority</td>
<td>63</td>
<td>15.3</td>
</tr>
<tr>
<td>Total</td>
<td>412</td>
<td>100.0</td>
</tr>
</tbody>
</table>

As shown in the table above, respondents gave out different opinions on how the issue of farmers living together with wild animals can be achieved. Majority 23.3% encouraging the community to stop the encroachment of national park land for agriculture production, 15.3% did mention strengthening the ties between the community and Uganda wildlife authority as this facilitate quick communication whenever there are attacks by animals, 13.8% cited the elimination poaching activities, 9.7% pointed out stopping bush and charcoal burning activities near and around protected areas, 9.2% said creating awareness in the community about the benefits of biodiversity conservation, 9% said relocating destructive wild animals from the prone areas, 8.5% pointed out protecting and gussetting national parks and game reserves, 6.6% encouraging communities to plant trees and 4.6% talked of strengthening biodiversity laws and policies.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Introduction
Chapter four discussed and presented data analysis and interpretation of research findings. This chapter summarizes the study, gives the discussions, conclusions, and recommendations of the research findings.

5.2 Socio-demographic characteristics

The study involved all the genders in the community and this is because Kiko town council has a large population who practice agriculture farming for livelihood survival. A large number of the farmers in the study area were married adults aged between 15 – 28 years, these largely practiced farming to get food to sustain their families. The lower levels of education justifies the reason majority of men and women in the area opt for farming so as to generate income and food to support their lives.

5.3 Factors leading to conflicts between agriculture and biodiversity conservation in the fringes

From the analysis of the findings a number of significant factors escalating the conflicts between agriculture production and biodiversity conservation in the fringes of Kibale National Park were determined. Among the highlighted factors was level of education of individuals in the community.

Level of education had a 24.7% influence on biodiversity conservation/ degradation. Educated people in the community were found to understand the likely benefits of biodiversity conservation as compared to the uneducated who look at conservation as a waste of time.

Distance between crop gardens and park in kilometers contributed 30.5% likelihood of causing conflicts between agriculture and wild animals. It was reported that members who had crop lands or had livestock in the nearby vicinity with the park, experienced a lot of crop raid and livestock killings by world animals than those who lived in far distances. Leaving in the neighborhood with the park puts crops, livestock as well as human beings at the risks of attacks by wild animals.
Type of crops growth and animals reared at households explained influenced conflicts between agriculture and biodiversity conservation by 30.7% and 29.3% respectively. Through interviews and observation, the study identified a number of food crops grown in the area. These included beans at 22.3%, maize 20.1%, cassava 14.3%, banana 12.6%, vegetables 12.4%, vegetables 12.4%, millet 10.9% and sorghum 7.3%. Seasonal crops are the most commonly grown as compared to perennial crops. These crops are usually intercropped due to limited land in the area, the cool climate characterized by two rainy season’s boots production in the area. These crops are usually attacked by wild animals like elephants, birds, monkeys, baboons and antelopes, in retaliation human beings have paid back by killing the animals. The type of animals reared at households also justified a 29.3% influence on the conflicts between agriculture and biodiversity conservation. Analyzed findings indicated that 90% of the farmers in the area had encountered attacks on the livestock, the animals usually attacked were mainly goats, cattle and all the categories of birds. The attackers were mainly lions, wild cats, hyenas, wild dogs, pythons, eagles and reptiles. These created a big loss to the farmers in terms of income. Specific wild life animals are carnivorous with different preferences, for example lions were reported to attack livestock including cattle, sheep and goats whereas eagles, wild cats, dogs, and reptiles made attacks on mainly poultry. To compensate for the losses made, humans have paid back by killing such animals through snaring and poising. Other human activities that had an influence on the conflicts between agriculture and biodiversity conservation in the fringes of Kibale national park included poaching that involved killing of both birds, reptiles and animals, and encroachment on the gazetted land that lead to displacement of habitats and ecosystem destruction. This study finding is support with (Butler, 2000) who stated that human activities such as husbandry, agriculture, fishing, the development of infrastructure or even of tourism or wildlife protection itself, can dramatically modify wildlife habitats either directly or indirectly.
Muhweezi, (2014) also supported the findings by say that the main cause of human-wildlife conflict worldwide is the competition between growing human populations and wildlife for the same declining living spaces and resources. The transformation of forests, savannah and other ecosystems into agrarian areas or urban agglomerates as a consequence of the increasing demand for land, food production, energy and raw materials, has led to a dramatic decrease in wildlife habitats. This is particularly true in Africa where the human population came close to tripling in the four decades from 1960 and where, in consequence, settled agriculture has spread to more marginal rangelands leading to encroachment into wildlife habitats. Under these conditions, conflict between wildlife and local communities has inevitably increased.

The findings of the study are in support with (Fischer, 2002) who stressed that drought, floods, civil unrest, natural disasters or war disrupt the normal production and distribution of food, resulting in famines. This phenomenon is on the increase; the number of food emergencies in Africa each year has almost tripled since the 1980s. Across sub-Saharan Africa, one in three people are undernourished. These factors spur the continuing migration of rural people into areas where resources could be obtained, and which are frequently occupied by wildlife. The resultant occupation of the habitat of wild animals by humans leads to conflict. War and civil unrest force people to seek shelter in protected areas where they exert a strong pressure on natural resources and enter into competition with wildlife.

5.4 Farmers coping strategies with the effects of conflicts arising biodiversity conservation in the fringes of Kibale national park

The analysis of the findings indicates that farmers in the area had identified a number of strategies to cope up with the effects of conflicts arising biodiversity conservation in the fringes of Kibale national park. 27.2% reported the cases to the Park Authorities whenever attacked, 24.5% lit the fire to scare away animals and 9% applied snares and killed the attackers. In a series of interviews and discussions with community members, it was reported that UWA has
helped farmers to cope up with the effects of conflicts arising from farming and biodiversity conservation in a number of ways including; Gazzeting and protecting the prone areas, educating and training the community members on techniques of chasing away animals whenever they attack, providing the community with chemical elements that repel wild animals, compensating households for raided crops and animals killed, and supporting the affected households. The findings of this study are in comparison with (Vermeulen, 2004 and Werner, 1990) who argued that coping mechanisms range from individualized self-protection to collective insurance based on social reciprocity. The former depends heavily on individual access to land, labor, and capital, which depend in turn on wealth and political influence. By contrast, communal coping mechanisms depend on kinship networks, traditions of sharing, reciprocity, and joint land management. The poorest, migrant households face compounding vulnerability. Without large landholdings or kin networks, they cannot buffer themselves from wildlife conflict, nor can they hire additional labor.

5.5 Perception of crop farmers towards the conservation of biodiversity resources

Conserving of biodiversity resources is important towards environmental conservation and protection, from the analysis of the findings, farmers were in agreement of having protected areas for wild animals especially near crop gardens and livestock systems. Farmers reported that having the park land gazzeted, minimizes crop raids and animal killings by 29.1%, eliminates encroachment on park land by 17.7% was to, protects against conflicts between agriculture farming and biodiversity conservation by 14.8%, guards against eco-system degradation by 11.7% as well as minimizes attacks on humans by 13.3%. La Grange, (2005) revealed that carefully targeted management practices applied to relatively small areas of cropped or non-cropped habitats within conventional agriculture may also provide valuable biodiversity benefits. Hoare, (2010) found that wild species richness generally increased with landscape heterogeneity on a farm scale, and habitat type had a major effect on species richness.
for most groups, with most species found in pastures and leys (lands temporarily sown with grass). The level of motivation of the farmer to maintain biodiversity on the farmstead was more predictive of biodiversity outcomes than specific practices.

The findings of this study are comparable to (Hanks, 2006) who said that organic farming industry has only recently begun to develop standards that explicitly address conservation of wild biodiversity. Hoare, (2010) found that a wide range of taxa, including birds, mammals, invertebrates and arable flora can benefit from organic management through increases in abundance and/or species richness. Management practices, such as prohibition or reduced use of chemical pesticides and inorganic fertilizers, protection of non-cropped habitats, and preservation of mixed farming, are particularly beneficial for farmland wildlife. Though yields from organic systems are still often lower than those in conventional systems, the gap is narrowing and research is accumulating that shows how agricultural production systems primarily or exclusively dependent on organic inputs can produce superior agronomic and economic results.

5.6 Alternative methods of biodiversity conservation that can allow co-existence with farming activities

Field findings indicated that there were possible ways conserving biodiversity that can allow co-existence with farming activities. These methods included; eliminating the encroachment of national park land, Gussetting national parks and game reserves, eliminating poaching activities, relocating destructive wild animals from the areas that are most affected, encouraging communities to plant trees, eliminating bush and charcoal burning activities near and around protected areas, strengthening biodiversity laws and policies, creating awareness in the community about the benefits of biodiversity conservation, strengthening the ties between the community and Uganda wildlife authority.

The findings of this study can be compared with (Wunder, 1997) who mentioned that top-down approaches to conflict management such as those listed above should always be complemented by bottom-up participatory schemes. Initiating bottom-up incentives when a conflict has been identified implies that the final agreement is thereafter based on a decision taken by
stakeholders themselves rather than a decision imposed from outside and/or by higher levels of administration. There now exists a wide range of deliberative and inclusionary processes, including citizens’ juries, consensus conferences, public meetings, focus groups, rapid and participatory rural appraisal, mediation meetings, etc. Deliberative and inclusionary processes can be particularly useful methods for stakeholder participation in environmental conflicts because of the uncertainty and complexity inherent to these conflicts. The selection of specific methods adopted for conflict management will, however, depend on the local political and social context, the issues at stake, resources available, and the stakeholders involved.

Fliesbach, (2016) revealed that legislation is a powerful tool in conflict management and could prove to be essential when dealing with potential conflicts involving increasingly problematic issues, such as the introduction of genetically modified organisms (GMO) and alien invasive species in both semi natural and natural areas. In Estonia, for example, although the release of alien species and GMOs without special permission is prohibited in the legal system, the law is unable to prohibit the escape into the wild of alien plants found in fields where it is legal to plant them. The use of legislative tools in conflict management should, however, be approached with caution for a number of reasons, including the difficulties often encountered in implementing laws, the often diffuse nature of environmental problems and the potential conflicts arising from antagonism toward laws about which stakeholders may not have been consulted.

5.7 Conclusion

Human-wildlife conflict is a significant problem in Uganda. The conflict has important consequences for local populations in terms of food security, safety and well-being, for the micro and macro economy, and also for wildlife conservation. Considering the current human population growth rate, the increasing demand for natural resources and the growing pressure for access to land, it is clear that the human-wildlife conflict
will not be eradicated in the near future. On the contrary, it will continue to grow as the district’s economy continues to be driven by the production of resources for supply to places where there is high demand. This is particularly true in Kabarole district particularly Kiko Town Council where subsistence agriculture continues to play a dominant role in supporting the community. Human-wildlife conflicts are usually brought about by several factors including; human activities like agricultural, charcoal burning, poaching and encroaching of park land. A series of measures are available to prevent or mitigate human-wildlife conflict. Well-designed human-wildlife conflict management plans which integrate different techniques can be adapted to solve the problem. Potential solutions can be selected based on their effectiveness, cost and human and social acceptability.

The most sensible approach in addressing human-wildlife conflict is to implement a combination of short-term mitigation tools alongside long-term preventive strategies. In this way immediate problems can be addressed while the rapid development of innovative approaches is fostered to address future issues and eradicate the problem in the long term.

5.8 Recommendations

Based on the study findings discussed in the chapters above, the researcher recommends the following;

Government in collaboration with UWA should intervene and provide a community based program. Community-based control of problem elephants helps alleviate crop damage when used in combination with other methods, though it does not necessarily offer a complete solution. Based on the findings observed in the area, the researcher recommends the adoption of a multi-stage approach to implement management measures, beginning with low-input, low-cost methods for which farmers can take full responsibility. If these methods do not succeed after a period of time, then higher-input methods should be implemented.
Government in collaboration with UWA should intervene and fully compensate the affected households, this compensation should be informed of food aid or monitory. This can help the affected households to cope up with the losses resulting from raids and domestic animal killings.

There is need to make demarcations for protected areas as this will help solve the problem of encroachment of park land by the community members. Demarcations should be made to identify the boundaries between park land and farm land.

The community should be sensitized about the benefits of conserving the environment, more emphasis should be put on farming practices that don’t not affect the environment and the overall ecosystem. Farmers should also be encouraged to cultivate crops and rear animals far away from the park so as to eliminate the risk of conflicts that may occur humans and wild life. Hush punishments should be put in place for members of the community who practice illegal activities like poaching and charcoal burning. This can help in reducing the number of wild animals killed by humans. On the other hand, it also protects against environmental degradation.

5.9 Areas for further research

The study recommends further research to be carried out on;

The effect of cultural values and beliefs on biodiversity conservation.

REFERENCES


Chetri, (2004); Securing protected area integrity and rural people’s livelihoods: Lessons from twelve years of Kibale and Semiliki conservation and development project.


Report to the International Foundation for the Conservation of Wildlife (Fondation IGF), Harare, Zimbabwe.


Naughton (1998); Predicting patterns of crop damage by wildlife around Kibale National Park; Uganda. Conservation biology.


UBOS (2014); provisional results of the 2014 National Population and Housing Census; Published November 2014.


APPENDICES

APPENDIX I: QUESTIONNAIRE FOR COMMUNITY MEMBERS

Dear respondent

I am Isingoma Fred Baker, a student of Bishop Stuart University carrying out a study titled “Coping with the conflicts between agriculture and biodiversity conservation in Kiko town council in the western parts of Kibale national park, Kabarole district”. The study is mainly for academic purposes only therefore the information given will be treated with at most confidentiality. Your name will not be required and there will be no rewards.

SECTION A: Demographic data
Name……………………………………………………………………
Telephone number……………………………………………………
Parish……………………………………………………………………
Village……………………………………………………………………
Position in the household………………………………………………

1. **Gender:**
   1. Male (  )
   2. Female (  )

2. **Age in years**

3. **Marital status**
   1. Never married (  )
   2. Married (  )
   3. Separated (  )
   4. Divorced (  )
   5. Widowed (  )
   6. Cohabiting (  )

4. **Educational level in years**

5. **Position in the community**
   1. Local leader (  )
   2. Farmer (  )
   3. UWA staff (  )
   4. Others specify

6. **Employment Status**
   1. Employed (  )
   2. Self-employed (  )
   3. Unemployed (  )

7. **Sources of income**
   1. Farming (  )
   2. Salary (  )
   3. Business (  )
   4. Others specify

**SECTION B: Factors leading to conflicts between agriculture and biodiversity conservation in the fringes of Kibale National Park**

1. How far is your garden from the park in kilometers? ..........................

2. Which types of crops do you grow? ............................................
3. Do you face any challenges with national park wild animals?

1. Yes ( )

2. No ( )

4. If yes, please list some of them:

1. Crop raiding ( )

2. Attack on birds ( )

3. Spread of livestock diseases ( )

4. Attack on human beings ( )

5. Attacks on livestock ( )

6. Any other specify ……………………………………….

5. Have your crop gardens been attacked by wild animals

1. Yes ( )

2. No ( )

5. If yes, name the most destructive animals

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………

6. Which type of crops are most affected by the raiders?

…………………………………………………………………………………………………………

…………………………………………………………………………………………………………
7. What is your average estimated financial loss per year resulting from crop raiding?

8. Have you had any attacks on your animals by wild animals in the last 6 months?
   1. Yes ( )
   2. No ( )

9. If yes which wild animals commonly attack your domesticated animals?

10. What is your average estimated financial loss per year resulting from animal killings?

SECTION C: Farmers coping strategies with the effects of conflicts arising biodiversity conservation in the fringes of Kibale National Park

1. How do you respond to the wildlife animals which an attack on you, your animals and crops
   1. Report to Park Authorities ( )
   2. Physical guarding of gardens and domestic animals ( )
   3. Lighting fire in the garden at night ( )
   4. Shifting from homes to gardens in temporary housing structures ( )
   5. Snaring/Killing ( )
6. Alert the neighbors ( )
7. Planting less palatable crop species ( )
8. Nothing is done ( )

2. In your own opinion do you think the above approaches effective?
   1. Yes ( )   2. Not really ( )   3. Not at all ( )

3. Has Uganda Wildlife Authority in any way helped you cope with the arising conflicts in the area?
   1. Yes ( )
   2. No ( )

4. If yes how?
   ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................

SECTION D: Perception of crop farmers towards the conservation of biodiversity resources

1. In your own opinion do you think it is good to have protected areas for wild animals?
   1. Yes ( )   2. Not sure ( )   3. Not at all ( )

2. Give the justification for your opinion above?
   ........................................................................................................................................
   ........................................................................................................................................
   ........................................................................................................................................
3. What are the benefits of conserving the biodiversity resources?

SECTION E: Alternative methods of biodiversity conservation that can allow co-existence with farming activities

1. Could there be any chance of farmers living together with wild animals?
   1. Yes ( )
   2. No ( )

2. If yes, how do you think this can be achieved?

3. What has government and national park management done to improve biodiversity conservation so as to allow co-existence with farming activities?
Thank you

APPENDIX II: A MAP SHOWING KIBALE NATIONAL PARK AND KIKO TOWN COUNCIL
APPENDIX III: WORK PLAN

This is the time that the researcher intends to do research from the proposal write-up, to data collection and analysis writing and submission of the final report.

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APPENDIX IV: STUDY BUDGET

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